Are Islamic and Conventional Capital Markets Decoupled? Evidence from Stock and Bonds/Sukuk Markets in Malaysia

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March 2, 2018

Abstract

This study examines the decoupling hypothesis between Islamic and conventional capital markets by analysing the dynamic interdependencies among conventional stock, Islamic stock, bonds and sukuk markets in Malaysia over the period January 3, 2007 to March 31, 2017. Empirical findings on the total spillover index show that, on average, one third of the total forecast error variance attributed to spillovers has affects across four markets, indicating that conventional and Islamic markets are highly interconnected. The conventional stock and bond markets are considered to be the main net transmitters of spillovers towards other markets, whereas the sukuk market is a net receipt of modest levels of return shocks from conventional, Islamic and bond markets throughout the sample period. The interlinkages and connectedness between sukuk and conventional bonds are robust compared with other markets but show variations in the spillovers over the period. While one way to explain the differences in the spillovers between the conventional bond and sukuk indices can be attributed to external factors such as the financial crisis, changes in the legal regime and political uncertainties, another explanation may lie in the differences in the contractual structures of these instruments.

Keywords: Conventional stock market, Islamic stock market, Bond market, Sukuk market, Return Spillovers, Malaysia

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1. Introduction

Launched in the 1970s, Islamic finance has grown rapidly in its short history to become a global phenomenon, and it constitutes significantly large sectors in many jurisdictions. The overall size of the Islamic financial services industry is estimated to be USD 1.89 trillion (IFSB 2017). The Islamic financial sector came into focus after the recent global financial crisis as some studies showed it fared relatively better than its conventional counterpart (Akhtar and Jahromi 2017, Almanaseer 2014, Cihak and Hesse 2010, Hasan and Dridi 2010). Its relative stability and better performance were attributed to some key features of Islamic financial contracts such as emphasis on risk-sharing, direct linkages with the real economy, low leverage and not dealing with toxic instruments and derivatives (Ahmed 2009, Ajmi et al 2014, El-Hawary et al. 2004). Proponents of Islamic finance argue that the industry is decoupled from conventional finance due to its distinct features and as such can provide an alternative asset class that is more stable.

Comparative empirical studies of conventional and Islamic financial markets show mixed results on the decoupling hypothesis. Three categories of comparative empirical studies examining the relationships between conventional and Islamic financial market segments can be identified:[1] relationship between conventional and Islamic stocks indices/funds; association between bond indices and Sukuk indices; and inter-linkages between conventional and Islamic stocks indices/funds, bond indices and sukuk indices.

The first category of research shows mixed results on the decoupling hypothesis. On the one hand, several studies such as Abdelrrezak (2008), Ajmi et. al. (2014), Dewandaru et. al (2014), Haddad et. al (2009), Hoepner et. al (2011), Hassan and Girard (2010), Mannoudeh et. al (2014), Rizvi et. al (2015), Shahzad et. al (2017) and Yilmaz et. al (2015) show a close association between Islamic and conventional capital markets with no significant difference between Islamic funds and their conventional counterparts and benchmarks. These studies support a weakening of the decoupling hypothesis showing the close affinity of Islamic financial and conventional funds and indices. On the other hand, Majdoub and Mansur (2014)

[1]There is another set of studies such as Aloui et. al (2015a and 2015b) that examine the linkages between Shariah compliant stocks and sukuk. Since the focus of this paper is on the interlinkages between the conventional and Islamic financial markets, this category is not included. Also see Abedifar et. al. (2015) for a brief overview of the recent literature on the topic.

find a weak relationship of MSCI Islamic indices across US and Rizvi and Arshad (2014) also find a weak correlation between five Islamic and four conventional indices supporting the decoupling hypothesis. While some empirical papers find that the Dow Jones Islamic market index outperforms its conventional counterpart in both absolute and risk adjusted returns (Hassan et. al. 2005, Hassan and Mohamad 2007, Hussein and Omran 2005, Hussein 2005, Wilson 2001), other studies indicate that the Kuala Lumpur Islamic index (KLSI) underperformed the Kuala Lumpur Composite index (KLCI) (Ahmad and Ibrahim 2002, Albaity and Ahmad 2008).

In the second group of studies examining the relationship between the bonds and sukuk markets, results appear to support differences. Using Value-at-Risk and Monte Carlo simulation methods, Cakir and Raei (2007) show that the correlation of returns on sukuk and Eurobonds is weak. ElMosaid and Boutti (2014) find that while returns on sukuk and bond indices are positively correlated, their average returns are significantly different. Hassan et. al (2017) find that while sukuk and EU and US bonds are cointegrated, the former are less volatile compared to the latter.

Studies in the third category examining the interaction between Islamic/conventional equity markets and bonds/sukuk markets are relatively scarce. Maghyereh and Awartani (2016) examine the transmissions between equity indices and sukuk/bond indices and find that sukuk are more exposed to net-transmissions from equities compared to bonds and there is relatively more volatility flowing from the bonds to sukuk than the other way round. Their results show a significant unidirectional volatility spillover from the sukuk market to stock market only during the crisis period. In a related study, Akhtar and Jahromi (2017) used daily return data for 19 Islamic and non-Islamic countries over the period 2002-2014 to analyse the impact of the global financial crisis on Islamic versus conventional stock and bond markets. Empirical findings indicate that Islamic financial markets are more stable compared to their conventional counterparts, especially during financial turbulences, due to the prohibition of risky activities. On the other hand, Islamic financial markets are not protected against recessions and business cycles, and they could be vulnerable like conventional markets to a change in investor sentiment and/or production level.

To understand the relationships between the Islamic and conventional stocks and bonds/sukuk markets, there is a need to understand the transmission mechanisms across markets on the one hand and the underlying contractual structures on the other hand. Fleming et. al (1998) maintain that information flows and cross hedging can explain linkages in price

movements in different financial sectors. They assert that information on some macroeconomic variables that affect one financial market can spill over to other markets. Thus, an information event that affects the volatility of stock returns will not only affect its demand but also indirectly alter the demand and prices of bonds due to changes in the portfolio undertaken to hedge against the new position in the former. However, the impact of information spillovers on volatility linkages and co-movement of asset prices will depend on institutional constraints, transactions costs, and other considerations that limit the cross-market hedging. One factor that can affect the inter-linkages between sectors is the underlying contractual structures of different financial products. The prohibitions on interest (riba) in financing, excessive uncertainty (gharar), gambling (maysir) and the use of hedging instruments such as derivatives in Islamic finance are likely to change the way in which information spill-overs arising in conventional markets affect the former (Maghyereh and Awartani 2016).

There are two hypotheses on the nature of Islamic financial contracts and the linkages between the Islamic and conventional financial markets (Hassan et. al 2017). The first is the theoretical perspective that asserts that the Shariah principles would introduce distinct asset- and equity based Islamic financial contracts that are distinct from the conventional interest-based financing (Iqbal and Mirakhor 2007). For example, sukuk certificates reflect ownership of underlying assets or projects which are different from debt-based bonds. Furthermore, prohibition on excessive uncertainty that restricts short-selling and speculation can also limit transmission of volatility across assets classes. The second view asserts that in reality Islamic financial products are strongly associated with their conventional counterparts and, as such, show close co-movements. The contention is that Islamic financial practices are very similar to conventional finance since the former is mimicking the latter and focuses on the form rather than the substance or spirit of Sharia (Azmat et. al. 2015, Irfan 2014, Khan 2010, Onder 2016).[2]

This paper contributes to the debate on the decoupling hypothesis and explores further the relationship between Islamic and conventional capital markets belonging to the relatively under-researched third category of empirical literature identified above. In particular, empirical analysis estimates the dynamic inter-linkages of Islamic stocks/sukuk indices with the conventional stock/bonds and examines the strengths/weaknesses of the time-varying

[2]The features of Islamic financial contracts and the differences between Islamic and conventional finance are discussed in Section 2.

spillovers from and to different sectors. While the paper is similar to Maghyereh and Awartani (2016) and Akhtar and Jahromi (2017), who study the transmission among global conventional/Islamic stocks, bonds and sukuk indices globally and indices for different countries, it differs from it by examining the inter-linkages between financial sectors in Malaysia, a country in the forefront of Islamic finance and with a relatively developed Islamic capital market. By examining the spillovers across stock and bonds/sukuk indices within one country, the paper is able to address the decoupling hypothesis within a framework where the sectors operate under the same macroeconomic environment and legal and regulatory regimes. The paper uses the spillover method proposed by Diebold and Yilmaz (2012), forecasting error variance decompositions from a generalized general VAR specification to show the direction and strength of the return spillover effects between markets attributable to various shocks to the VAR model.

The paper is organized as follows. While section 2 presents the features of Islamic financial contracts and Shariah compliant stocks and sukuk, section 3 presents the data sources and preliminary analysis and section 4 outlines the methodology used in the empirical model. After presenting the results in section 5, the last section concludes the paper.

2. Islamic Finance Contracts and Capital Market Products

Islamic financial products are governed by Islamic commercial law which prohibits *riba* (literally meaning 'excess') and *gharar* (legal ambiguity or excessive risk) in transactions. While *riba* is usually translated as interest, it has wider connotations such as prohibition of the sale of debt. Similarly, contemporary derivatives (forwards, futures, swaps, etc) are not permissible as they have elements of both *riba* and *gharar*. Since interest is prohibited, Islamic finance uses various other permissible contracts to structure financial products. The key contracts used in practice can be broadly classified as sale, leasing, partnership and agency. [3]

Shariah compliant stocks are identified by applying two layers of screening on the universe of all stocks.[4] The first screening is a qualitative business activity screening that eliminates companies that are involved in products and services that are considered prohibited. These would include tobacco, alcohol, pornography, weaponry, casino games, pork-related products, conventional financial institutions and so on (BinMahfouz and Ahmed 2014,

[3]Detailed expositions of the different principles of Islamic financing are found in Ahmed (2011), Ayub (2007), Kahf and Khan (1992) and Usmani (1999).

[4] For discussion on stock screenings see BinMahfouz and Ahmed (2014) and Derigs and Marzban (2008).

Obaidullah 2005, Derigs and Marzban 2008). At the second level, a quantitative financial screening is carried out on companies that pass the qualitative screening. Financial screenings identify the permissible benchmarks to exclude companies with unacceptable levels of conventional debt, liquidity, interest-based investment and/or impure income (Khatkhatay and Nisar 2006, Derigs and Marzban 2008). Firms that pass both qualitative and quantitative screening thus constitute Shariah compliant stocks.

S*ukuk* is defined as certificates representing "shares and rights in tangible assets, usufructs and services, or equity of a given project or equity of a special investment activity" (AAOIFI 2003: 298). AAOIFI identifies 14 types of *sukuk* that can be classified broadly as assets, debt, equity and investment agency based (AAOIFI 2003, Safari et. al. 2014). *Sukuk* are securities representing ownership in equity, real assets, usufruct, money, debt or any combination of these. Holders of *sukuks* are the owners of the rights and bear the risks that these instruments represent. Depending on the contractual basis used, *sukuks* can have fixed or variable returns and may be tradable. Sukuk representing debt or money are not negotiable and can be exchanged at par value only. Thus, along with equity shares, instruments can be securitised and traded at negotiable prices if these represent real physical assets or usufruct.

Understanding the differences/similarities between Islamic finance and conventional finance would require examining the underlying features of Islamic financial products and practices to understand the possible linkages that exist between them.

In capital markets the linkages between the Islamic and conventional segments will depend on the type of instruments considered. As indicated, Islamic stocks are a sub-set of the overall conventional stock market derived through applying two levels of screening. Thus, while all Islamic stocks are included in the conventional stocks universe, elimination of certain sectors and companies in the former can result in different risk/return implications compared to the latter. On the one hand, Islamic stocks are expected to be relatively more stable since they exclude highly leveraged firms. One the other hand, since the stock universe of Islamic equity markets is relatively smaller than their conventional counterparts, the benefits of diversification would be relatively less.

The relationship between sukuk and bonds will depend on the type of sukuk. Although AAOIFI identifies 14 different types of sukuk, in practice they can be broadly classified as asset-backed and asset-based sukuk (Ahmed 2010, Dusuki and Mokhtar 2010). The former is considered to be a true sale whereby the assets are transferred from the originator to the

investors or sukuk-holders. In the case of bankruptcy of the obligor, the investors would have recourse to the asset and will have priority of claims over unsecured creditors. Asset-based sukuk, however, replicates a conventional unsecured bond and uses an asset in the contract to fulfil formal Shariah requirements. The requirement of transferring the ownership in the sale of the asset is allegedly fulfilled in its beneficial or constructive ownership by the investors. In reality, the sale of the underlying asset is not true either from accounting or legal (English law) perspectives (Dusuki and Mokhtar 2010). Thus, while the asset backed sukuk is expected to be decoupled from conventional bonds, asset-based sukuk will behave very similar to them.

3. Data sources and preliminary analysis

As indicated, this paper assesses the decoupling hypothesis for Islamic and conventional capital markets by examining the spill-over and transmissions between Islamic stocks/sukuk and conventional stocks/sukuk markets. Malaysia is chosen since the country has one of the most developed Islamic financial sectors in general and has the largest Islamic capital market globally. The Islamic financial sector accounted for 25.5% of the total global assets in 2013 with 76 Islamic financial institutions and an estimated asset value of US$ 423.3 billion (CIBAFI et. al 2015: 5). The Malaysia capital market is valued at RM 2.733 trillion (USD 810 billion) of which 56.4% are Shariah compliant during the same year. The Islamic equity market constituted stocks amounting to RM 1.029 trillion and the *sukuk* market was worth RM 512.1 billion (CIBAFI et. al 2015: 199).

For performance comparisons, the dataset used in this paper consists of the daily closing prices of four Malaysian Islamic and conventional financial markets over the period ranging from January 3, 2007 to March 31, 2017 with a total of 2672 daily observations. The time period has been determined by the availability of data. The daily returns of two Islamic and two conventional indices are obtained from DataStream, these are: MSCI Malaysia Islamic Stock Market Index (ISR), MSCI Malaysia Stock Market Index (CSR), Thomson Reuters Sukuk Index (IBR) and Thomson Reuters Conventional Bond Index (CBR).

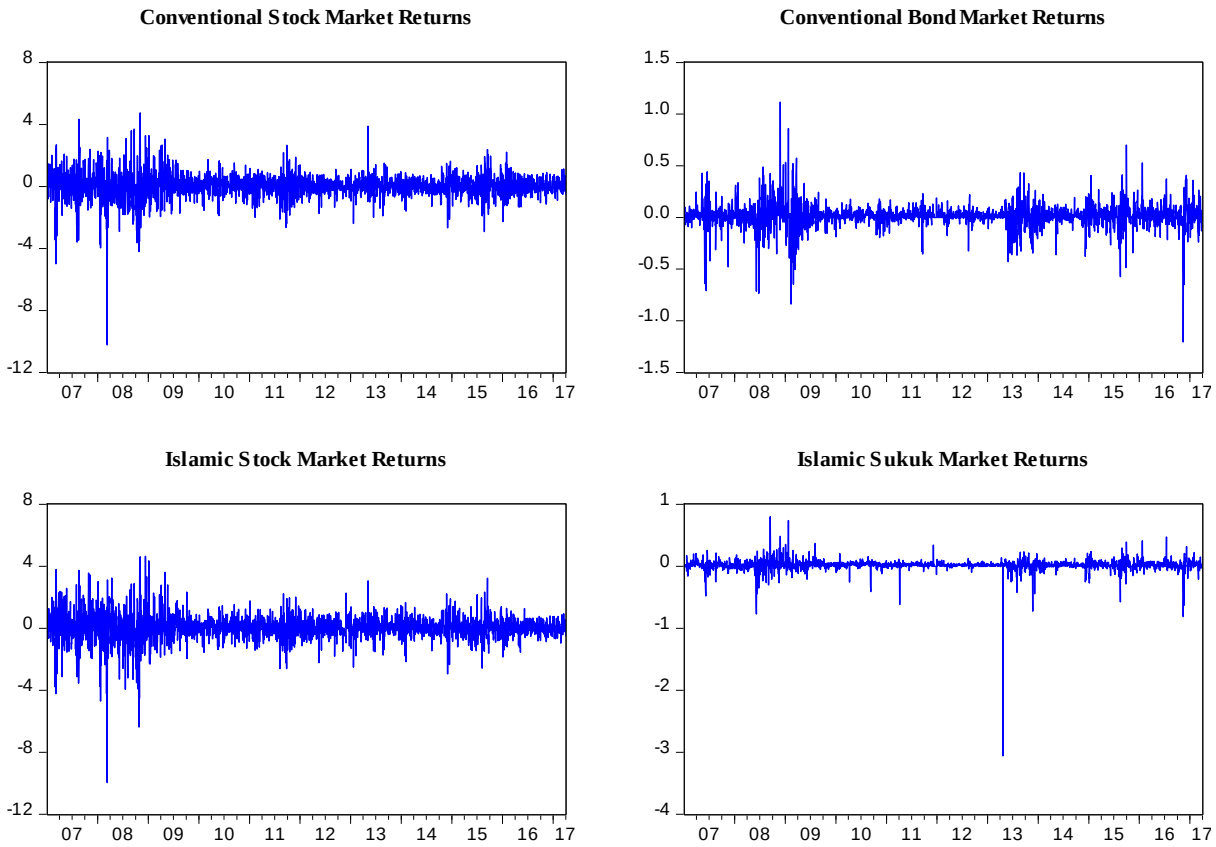


Fig. 1. Conventional and Islamic stock market returns, Conventional bond and Islamic Sukuk returns over the sample period 3/1/2007-31/3/2017 (a total of 2672 observations).

Table 1 provides the descriptive statistics of Islamic Stock return and Sukuk returns as well as their conventional counterparts, whereas figure 1 plots the variation of the underlying series over time. According to panel (A) in table 1, stocks (Islamic and Conventional) have higher returns compared to Sukuk and Bonds. However, they are more highly volatile relative to Sukuk and Bonds. The Jarque–Bera statistics reject the null hypotheses for all markets; therefore, all the series are not normally distributed. In addition, the Ljung–Box test statistics at lag 10, Q (10), provide evidence of autocorrelation for all return series. In Panel (B), unit root tests (Augmented Dickey-Fuller, Phillips-Perron and Zivot-Andrews) with just a constant indicate that all series are level stationary at the 1% significance level which motivates the use of a VAR model in our analysis. Finally by looking at the correlation matrix in panel (C), we can observe a positive and very high correlation between Islamic stock return and Conventional stock return with a correlation coefficient equalling (0.9).

Table 1: Summary statistics, unit root tests, and correlations

Panel A: Summary Statistics

	CSR	CBR	ISR	IBR
Mean	0.026	0.014	0.033	0.016
Median	0.011	0.015	0.002	0.016
Maximum	4.739	1.116	4.641	0.799

Minimum	-10.228	-1.204	-9.961	-3.060
Std. Dev.	0.801	0.115	0.848	0.099
Skewness	-0.950	-0.670	-0.828	-11.853
Kurtosis	17.042	19.062	15.735	352.321
JB	22355***	28924***	18362***	13648115***
LB (10)	39.53***	160.22***	26.81***	140.42***
Observations	2672	2672	2672	2672
Panel B: Unit Root Tests				
ADF	-46.18***	-41.99***	-47.30***	-21.45***
PP	-46.14***	-42.80***	-47.33***	-44.86***
Zivot-Andrews	-47.79***	-43.50***	-48.72***	-44.06***
Panel C: Correlation Matrix				
CSR	1.000			
CBR	0.102***	1.000000		
ISR	0.902***	0.066***	1.000000	
IBR	0.094***	0.511***	0.087***	1.000000

Notes: This table reports the statistics for the returns on the main variables used in the empirical analysis over the full sample starting from 3 January 2007 to 31 March 2017. (CSR) stands for Conventional Stock Market Index, (CBR) stands for Conventional Bond index, (ISR) stands for Islamic Stock Index, and (IBR) stands for Islamic Bond index. JB is the Jarque–Bera test for the null hypothesis of normality. LB (10) is the Ljung–Box test of the null hypothesis that there is no autocorrelation up to lag 10. Panel B reports results of the Augmented Dickey-Fuller, Phillips-Perron and Zivot-Andrews unit root tests with a constant term where the lag length is determined by the Schwartz Information Criteria (SIC). Critical values for the ADF and PP unit root tests are based on MacKinnon (1996) whereas critical values for the Zivot-Andrews test are taken from Zivot and Andrews (1992). The significance levels are indicated as follows: '***' $p<0.01$, '**' $p<0.05$, '*' $p<0.1$.

4. Empirical methodology

This study utilises the methodological approach of Diebold and Yilmaz (2012) which provides separate measures of return spillovers between series based on forecast error variance decompositions from a Vector Autoregressive (VAR) model. Diebold and Yilmaz (2009) suggest decomposing the forecast error variances based on Cholesky decomposition which is commonly used to identify VAR model shocks. The main limitation of this approach is that the resulting variance decomposition is sensitive to the ordering of the variables in the VAR model. To address this issue, Diebold and Yilmaz (2012) utilize the generalized VAR framework of Koop et al. (1996), hereafter KPPS, and Pesaran and Shin (1998) which provides variance decompositions that are invariant to the ordering of the variables in the

VAR model. The main advantage of this VAR specification is that it allows the data to declare the direction and strength of the spillover effects. Following Diebold and Yilmaz (2012), a K-variable VAR model of p-th order can be described as follows:

$$y_t = \sum_{i=1}^{p} \Phi_i y_{t-i} + \varepsilon_t \text{, with } \varepsilon_t \sim \text{i.i.d } (0, \Sigma) \quad (1)$$

Hereby $y_t = (y_{1t}, y_{2t}, \dots, y_{Kt})$ represents a vector of K endogenous variables, the daily returns of four time series: Conventional Stock Market Index (CSR), Conventional Bond index (CBR), Islamic Stock Index (ISR), and Islamic Sukuk index (IBR). Φ_i are $K \times K$ parameter matrices where $i = 1,2, \dots p$, and ε_t is a vector of identically and independently distributed errors with zero mean and Σ variance-covariance matrix. Assuming covariance stationarity, the moving average representation of the VAR(p) model can be written as follows:

$$y_t = \sum_{i=0}^{\infty} A_i \varepsilon_{t-i} \quad (2)$$

where A_i are the coefficient matrices of dimension $K \times K$ and are recursively defined by $A_i = \Phi_1 A_{i-1} + \Phi_2 A_{i-2} + \cdots + \Phi_p A_{i-p}$ where A_0 is the $K \times K$ identify matrix and $A_i = 0$ for all $i < 0$.

Using variance decompositions, the forecast error variances of each variable can be divided into two parts: own-variance shares and cross-variance shares (hereafter spillovers) based on shocks to the system. Own-variance shares represent the proportion of the h-step-ahead error variance in forecasting y_i due to its own shocks, whereas cross-variance shares show the fraction of h-step-ahead error variance in forecasting y_i that is attributable to shocks in the other variables y_j, where $j \neq i$. Based on the KPPS-VAR framework, the h-step-ahead forecast error variance that is invariant to the variables ordering can be defined as:

$$\phi_{ij}(h) = \frac{\sigma_{jj}^{-1} \sum_{h=0}^{H-1} (\acute{e}_i A_h \sum e_j)^2}{\sum_{h=0}^{H-1} (\acute{e}_i A_h \sum \acute{A}_h e_i)} \tag{3}$$

Here, $\sum$ is the variance matrix for the error vector ε, σ_{jj} denotes the standard deviation of the error term for the j-th equation, and e_i represents the selection vector with one for the i-th elements and zero otherwise. The resulted matrix ϕ_{ij} of dimension $K \times K$ represents the contribution of variable j to the h-step-ahead error variance in forecasting variable i. Hence, the main diagonal elements of this matrix show the own-variance shares while the off diagonal elements indicate cross-variance shares. Furthermore, unlike the Cholesky variance decomposition, the generalized variance decomposition matrix does not orthogonalize the shocks to each variable and, as a result, the sum of each row, that is own and cross-variance shares for each variable, is not equal to 1 ($\sum_{j=1}^{K} \phi_{ij}(h) \neq 1$). Therefore, each entry of the generalized variance decomposition matrix is normalized by the row sum as follows:

$$\widetilde{\phi}_{ij}(h) = \frac{\phi_{ij}(h)}{\sum_{j=1}^{K} \phi_{ij}(h)} \tag{4}$$

where by construction $\sum_{i=1}^{K} \widetilde{\phi}_{ij}(h) = 1$ and $\sum_{j=1}^{K} \widetilde{\phi}_{ij}(h) = K$.

The total spillover index is then calculated using the KPPS normalized variance decomposition matrix as follows:

$$TSI(h) = \frac{\sum_{i,j=1, i \neq j}^{K} \widetilde{\phi}_{ij}(h)}{\sum_{i,j=1}^{K} \widetilde{\phi}_{ij}(h)} \times 100 = \frac{\sum_{i,j=1, i \neq j}^{K} \widetilde{\phi}_{ij}(h)}{K} \times 100 \tag{5}$$

This index captures on average how much of the shocks spill over across all other variables (markets). This representation is quite useful as it allows us to measure directional spillovers across markets. More specifically, the directional spillovers received by market i *from* all other markets are proposed by the following equation:

$$DS_{i\leftarrow j}(h) = \frac{\sum_{j=1,j\neq i}^{K} \tilde{\phi}_{ij}(h)}{\sum_{i,j=1}^{K} \tilde{\phi}_{ij}(h)} \times 100 = \frac{\sum_{j=1,j\neq i}^{K} \tilde{\phi}_{ij}(h)}{K} \times 100 \quad (6)$$

Similarly, the spillover effects transmitted by market i *to* all other markets are given as:

$$DS_{i\rightarrow j}(h) = \frac{\sum_{j=1,j\neq i}^{K} \tilde{\phi}_{ji}(h)}{\sum_{i,j=1}^{K} \tilde{\phi}_{ji}(h)} \times 100 = \frac{\sum_{j=1,j\neq i}^{K} \tilde{\phi}_{ji}(h)}{K} \times 100 \quad (7)$$

The difference between gross volatility shocks transmitted by market i and those received from all other markets is defined as the net spillovers index and is written as follows:

$$NS_i(h) = DS_{i\rightarrow j}(h) - DS_{i\leftarrow j}(h) \quad (8)$$

Finally, given the directional spillovers indices, net pairwise return spillovers could be obtained directly as the difference between the gross return spillover transmitted from market i to market j and those transmitted from j to market i. Following Diebold and Yilmaz (2012), the net pairwise return spillover from market i to market j is estimated as follows:

$$NPS_{i\rightarrow j}(h) = \left(\frac{\tilde{\phi}_{ji}(h)}{\sum_{i,n=1}^{K} \tilde{\phi}_{in}(h)} - \frac{\tilde{\phi}_{ij}(h)}{\sum_{j,n=1}^{K} \tilde{\phi}_{jn}(h)}\right) \times 100 = \left(\frac{\tilde{\phi}_{ji}(h) - \tilde{\phi}_{ij}(h)}{K}\right) \times 100 \quad (9)$$

5. Empirical findings

In the following sub-sections, results of the static spillover index (average estimate of spillovers over the full-sample period) will be presented based on the generalised variance decomposition matrix using a daily KPPS-VAR model of order 1 and 10-step ahead forecasts. The Schwarz Bayesian Information Criterion (BIC), Akaike Information Criterion (AIC) and Hannan-Quinn information criterion (HQ) are used to determine the optimal lag length for the VAR models. Subsequently, total, directional and net pairwise spillover indices are estimated to investigate the time-varying return connectedness among Islamic and conventional financial markets using forecast error variance decomposition with a 150 trading day moving window. Meanwhile, directional spillovers as well as pairwise spillovers are used to determine how much each market receives (transmit) from (to) all the other markets.

5.1.Full-sample analysis

Table 2 shows the results for the return spillover indices based on the 10-days ahead forecast error variance decomposition where each ij^{th} entry estimates the contribution to i^{th} market's

forecast error variance generated by shocks to market *j*. Hence, the diagonal elements of the forecast error variance decomposition matrix (*i=j*) estimates intra-market spillovers (i.e., own-variance), whereas the off-diagonal elements (*i≠j*) represent the inter-market (i.e., cross-variance) spillovers of shocks. The last column gives the aggregated off-diagonal row sums (directional from others) and the off-diagonal column sums represent contributions to others. The differences between contributions to/from others (net contributions) are shown in the last row of the table.

Table 2 provides a summary of the average return spillovers as well as intra-market and inter-market spillovers over the full-sample period. It is clear that the intra-market return spillovers (diagonal elements) account for a large proportion of forecast error variance in the sample compared with inter-market spillovers (off-diagonal elements). The table shows that the intra-market return spillovers explain 54.7%, 79.4%, 54.5% and 76.7% of shocks to the Conventional stock market, Conventional bond market, Islamic stock market, and Islamic Sukuk market respectively. This indicates that both Conventional bond and Sukuk markets are not fully integrated with the Malaysian financial system. This result has been confirmed by gross directional return spillover measures, where the contributions of Conventional bond and Sukuk markets to others are weaker than the contributions of Conventional and Islamic stock markets. In particular, Conventional bond and Sukuk contribute 22.2% and 20.1% respectively to other markets while Conventional and Islamic stocks contribute 46.9% and 45.3% respectively.

Table 2: Total return spillovers

	From				
To	CSR	CBR	ISR	IBR	Contr. from others
CSR	54.79	0.52	44.23	0.46	**45.20**
CBR	1.01	79.40	0.34	19.25	**20.60**
ISR	44.85	0.20	54.58	0.36	**45.40**
IBR	1.03	21.50	0.72	76.74	**23.30**
Contr. to others	**46.90**	**22.20**	**45.30**	**20.10**	
Contr. including own	101.70	101.60	99.90	96.80	**Total Spillover Index=33.6%**
Net Contr. (Spillovers)	**1.70**	**1.60**	**-0.10**	**-3.20**	

Notes: The underlying generalised variance decomposition matrix is based on a daily VAR of order 1 with 10-step ahead forecasts. The number of lags (1) has been selected based on the Schwarz information criterion (SIC), Akaike Information Criterion (AIC) and Hannan-Quinn information criterion (HQ). The last column gives the aggregated off-diagonal row sums (directional from others) and the off-diagonal column sums represent contributions to others. The differences between contributions to/from others (net contributions) are shown in the last row of the table.

Furthermore, inter-market spillovers show that both Conventional stocks and Islamic stocks are highly interlinked and connected with each other whereas Conventional bond and Sukuk are more closely related and attached to each other. The table shows that 44.8% of the forecast-error variance for the Islamic stock market returns comes from the Conventional stock market and the return spillover from the Islamic stock market to the Conventional stock market is also relatively large at 44.2%. The strong spillovers between the conventional and Islamic stock market returns can be explained by features of the latter. As indicated, the Islamic stocks are identified by carrying out sector specific and financing screenings on all stocks. Since Islamic stocks are a subset of the conventional stocks, it is expected that they will have similar features and have high correlations.

The spillovers between conventional bond returns (CBR) and sukuk returns (IBR) are relatively smaller than those for stock markets. While the return spillover from the conventional bonds market to Sukuk market stands at 21.5%, it is 19.25% in the opposite direction. This can be partly explained by the different contractual structures of bonds and sukuk. As indicated above, while asset-based sukuk will have similar features as bonds, asset-backed sukuk and bonds are expected to have weaker relationship as the former is structurally different from the latter. A relatively moderate level of spillovers between the bonds and sukuk markets indicate that the latter has components of both types of sukuk.

The spillovers from the conventional stock market to the bonds and sukuk markets is small with only 1% of both the Conventional bond and Sukuk forecast-error variance being able to be attributed to the Conventional stock market. Similarly, the spillovers from the Islamic stock market to both the Conventional bond and Sukuk are also small at 0.3% and 0.7% respectively. The low levels of spillovers between the stock and bond/sukuk markets imply that linkages through information flows and cross hedging are identified by Fleming et. al. (1998) and are weak in these relationships.

According to the net directional spillovers, conventional stock and bond markets are considered to be key net transmitters of return spillovers (1.7% and 1.6% respectively) while Islamic Sukuk is the most important receiver of spillovers (-3.2%) and to some extent the

Islamic stock market (-.0.1%). Finally, empirical results in table 2 reveal that the total spillover index over the entire sample is 33.6%, indicating that those financial markets are highly interconnected and linked together where one third of the total forecast error variance can be attributed to return spillovers across four markets.

5.2.Rolling-sample analysis

Even though results from the spillover table and index are very informative and provide useful information on the average return spillovers over the entire sample, it might mask important information such as the dynamic evolution of the relationship between Islamic and conventional financial markets and, as a result, the cyclical movement in the spillover index overtime. To this end, time-varying spillover indices are estimated using 150 trading-day rolling windows. Figure 2 graphically depicts the dynamic total return spillover index which exhibits a large variation over the sample period. The total return spillovers increased to 43.8% and 45.1% during the first quarter and September 2008 due to the Credit Crunch and collapse of Lehman Brothers 2007/2008. During 2009, these values remained high as a result of the worldwide spread of the global financial crisis and political instabilities. Subsequently, the return spillover index started to decline from the end of 2009 to reach its lowest value, 22% and 23.8% in April 2010 and June 2012 respectively, before continuously escalating to 37%, 49.2%, 52.2% and 57.1%. Some plausible explanations for the trends can be the enactment of the Financial Services Act and Islamic Financial Services Act in March 2013, the Malaysian Airlines problems during 2014, the Chinese financial market collapse in August 2015, and the political instability and strikes in November 2016. According to this figure, the total spillover index is very responsive and sensitive to external shocks as well as economic and political turbulences.

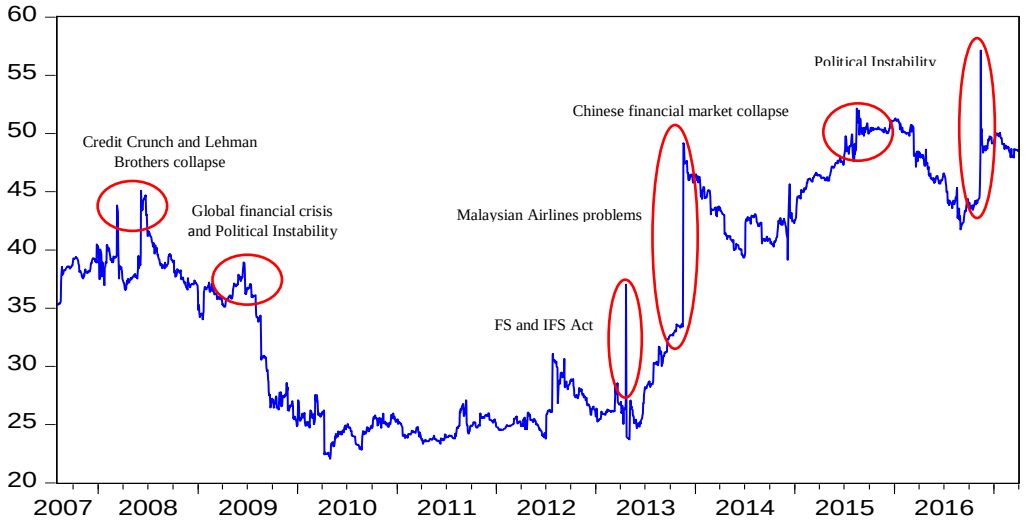


Fig. 2 total return spillover index over the sample period 2/8/2007-31/3/2017. Note: these time-varying total spillover index has been estimated based on a daily VAR model of order 1 with 10-step ahead forecasts and 150-days rolling windows.

5.3.Net and Directional spillover indices

In this section we examine the net and directional spillover effects among the four financial markets using the abovementioned VAR model with a 150-day rolling windows approach. Figure 3 presents the time-varying directional spillovers received by each market *from* all other financial markets (corresponding to "contribution from others" column in Table 2 using a 150 trading-day rolling window). Meanwhile, figure 4 exhibits the dynamic directional return spillovers from each of the four financial markets *to* others (related to the "contribution to others" row in Table 2 using a 150 trading-day rolling window).

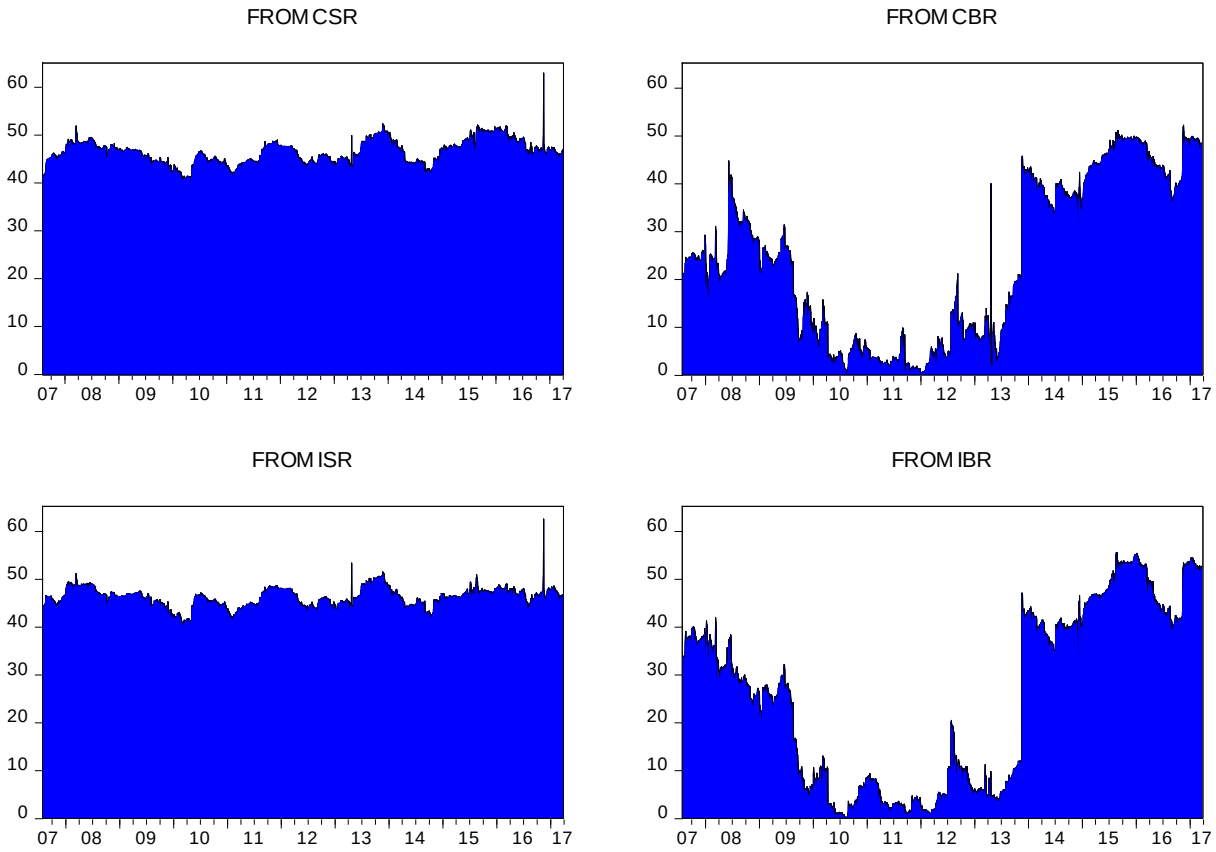


Fig. 3 Directional return spillovers *from* the Conventional stock market (CSR), Islamic stock market (ISR), Conventional bond market (CBR) and Islamic Sukuk market (IBR) over the sample period 2/8/2007-31/3/2017. Note: these time-varying directional spillover indices have been estimated using a daily VAR model of order 1 with 10-step ahead forecasts and 150-day rolling windows.

Noticeably, all directional spillover indices exhibit a large variation over the entire sample period. The spillovers *from* and *to* are quite high and persistent over the entire sample, ranging from 40% - 63% and 32% - 62% respectively for both Islamic and conventional stock markets, which indicate that those two markets are closely linked and highly integrated

with each other. On the other side, the spillovers *from* and *to* for both Sukuk and bond markets behave similarly over time and exhibit an identical pattern to the total spillover index. During the tranquil period (end of 2009 - May 2012), the directional spillovers for Sukuk and bond markets are very low and below 20%. However, they generally peak during economic and political turbulences and reach up to 56% and 80% respectively.

Overall, it is clear that spillovers from all four financial markets are more or less similar to spillovers to them and reveal similar patterns, suggesting that shocks to the Malaysian financial system tend to partially offset each other and hence Malaysia has a more stabilized financial system due to high diversification and risk sharing.

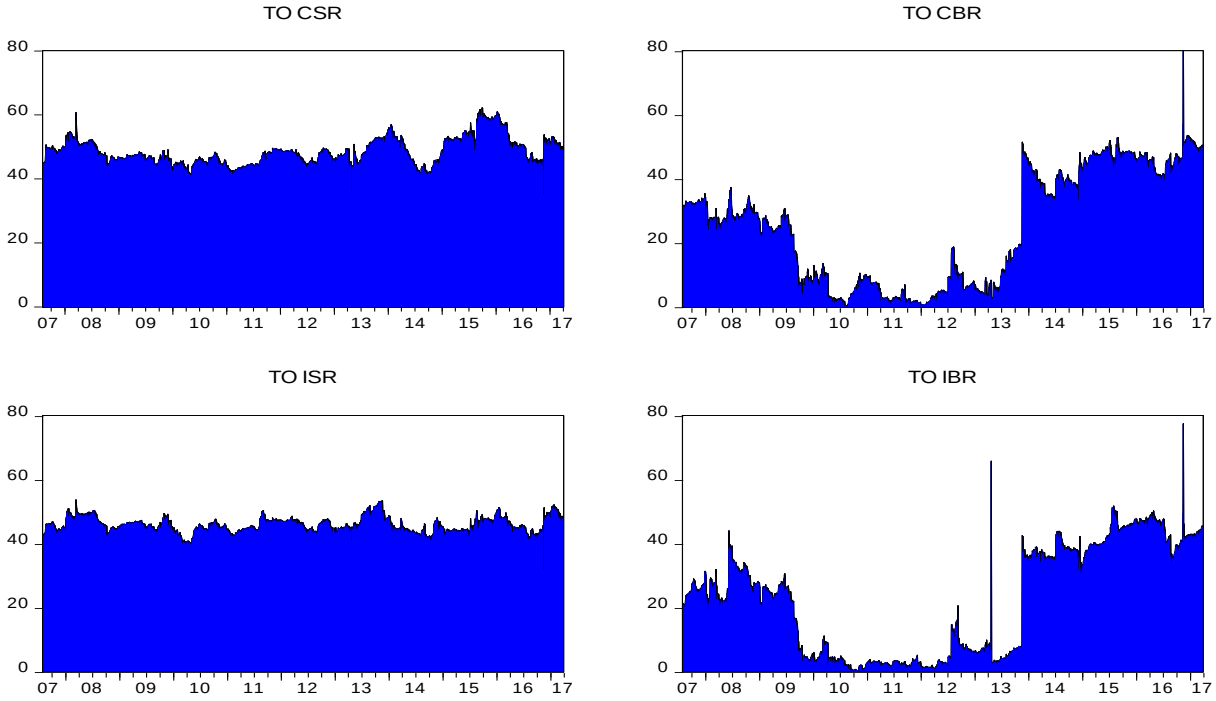


Fig. 4 Directional return spillovers *to* the Conventional stock market (CSR), Islamic stock market (ISR), Conventional bond market (CBR) and Islamic Sukuk market (IBR) over the sample period 2/8/2007-31/3/2017. Note: these time-varying directional spillover indices have been estimated using a daily VAR model of order 1 with 10-step ahead forecasts and 150-day rolling windows.

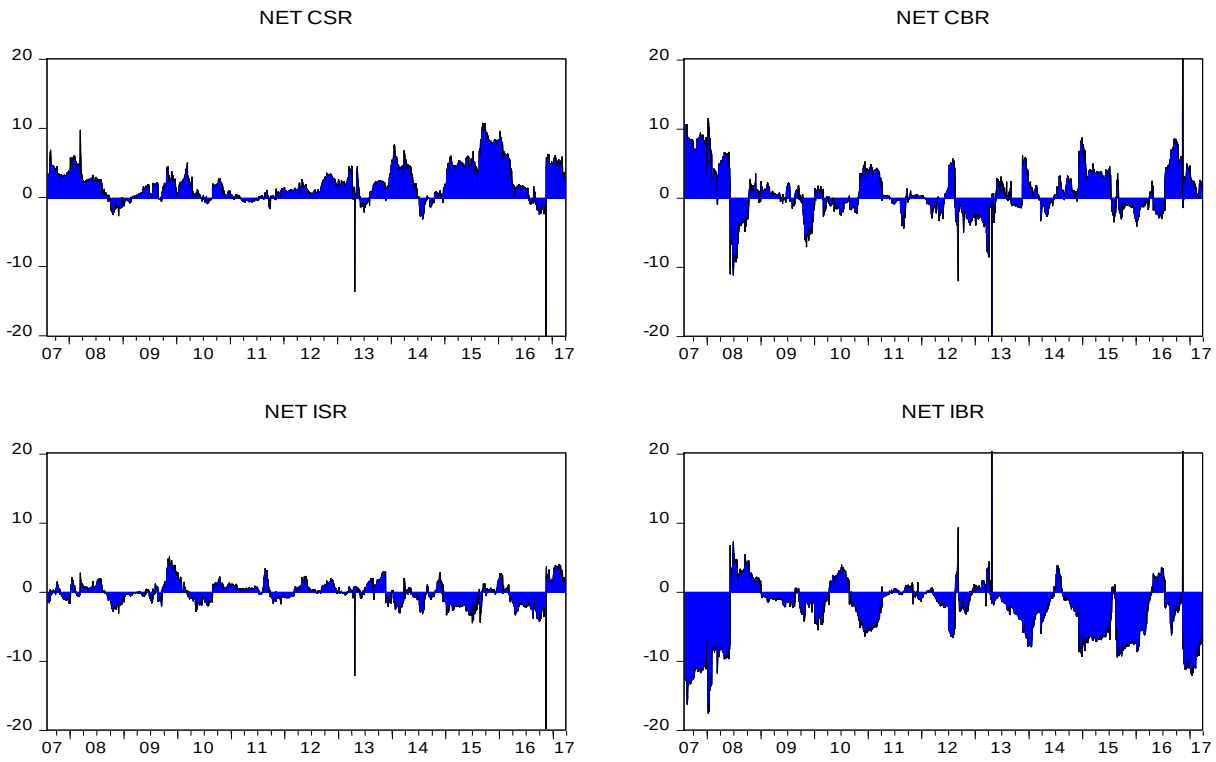


Fig. 5 Net directional return spillovers from the Conventional stock market (CSR), Islamic stock market (ISR), Conventional bond market (CBR) and Islamic Sukuk market (IBR) over the sample period 2/8/2007-31/3/2017. Note: these time-varying directional spillover indices have been estimated using a daily VAR model of order 1 with 10-step ahead forecasts and 150-day rolling windows.

In addition, the examination of dynamic directional spillover indices also enables us to estimate the net transmitters and receivers of spillovers across four financial markets and determine which market is the leading contributor to total spillovers. Figure 5 illustrates the time-varying net directional spillover indices across markets measured as the difference between "contribution from others" column and "contribution to others" row for each market in Table 2.

The most notable feature is the overwhelming dominance of the conventional stock market over the sample period. In particular, the conventional stock market appears to be the most important transmitter of return spillovers whereas the Islamic Sukuk market seems to be the most notable receiver of return spillovers. Also, to some extent the conventional bond market was a net transmitter while net return spillovers from the Islamic stock market tends to fluctuate and switch between positive and negative values over the sample period. Moreover, net return spillovers from the Islamic stock market tend to be smaller than that of other markets.

Another striking feature is that during difficult times, financial and political instabilities, such as the Credit Crunch and collapse of Lehman Brothers 2007/2008, the Global financial crisis

2009, Malaysian Airlines problems 2014, Chinese financial market collapse 2015, and the political instability and strikes in Malaysia during 2015/2016, return shocks spilled over mostly from the conventional stock and conventional bond markets to both Islamic and Sukuk markets.

5.4. Net pairwise spillover indices

Next we turn our attention to the pairwise directional return spillovers. We provide a visualization of the dynamic analysis of the net pairwise directional spillovers (NPS_{ij}) among each pairs of the four financial markets over the sample period where positive (negative) values of the net pairwise index indicate that market *i* is a net transmitter (receiver) of innovations to (from) market *j*. Figure 6 shows that the conventional stock market is considered to be the main net transmitter of spillovers towards the Islamic stock, conventional bond and Sukuk markets throughout the sample period. On the contrary, the Sukuk market is a net recipient of modest levels of return shocks from all other markets. Despite this, the interlinkages and connectedness between sukuk and Conventional bonds are very robust compared to other markets. Another interesting result is that shocks in the Islamic stock market spilled over mostly to the Sukuk market and also to the conventional bond market. Nonetheless, the spillover effects transmitted to the conventional bond market could be considered negligible.

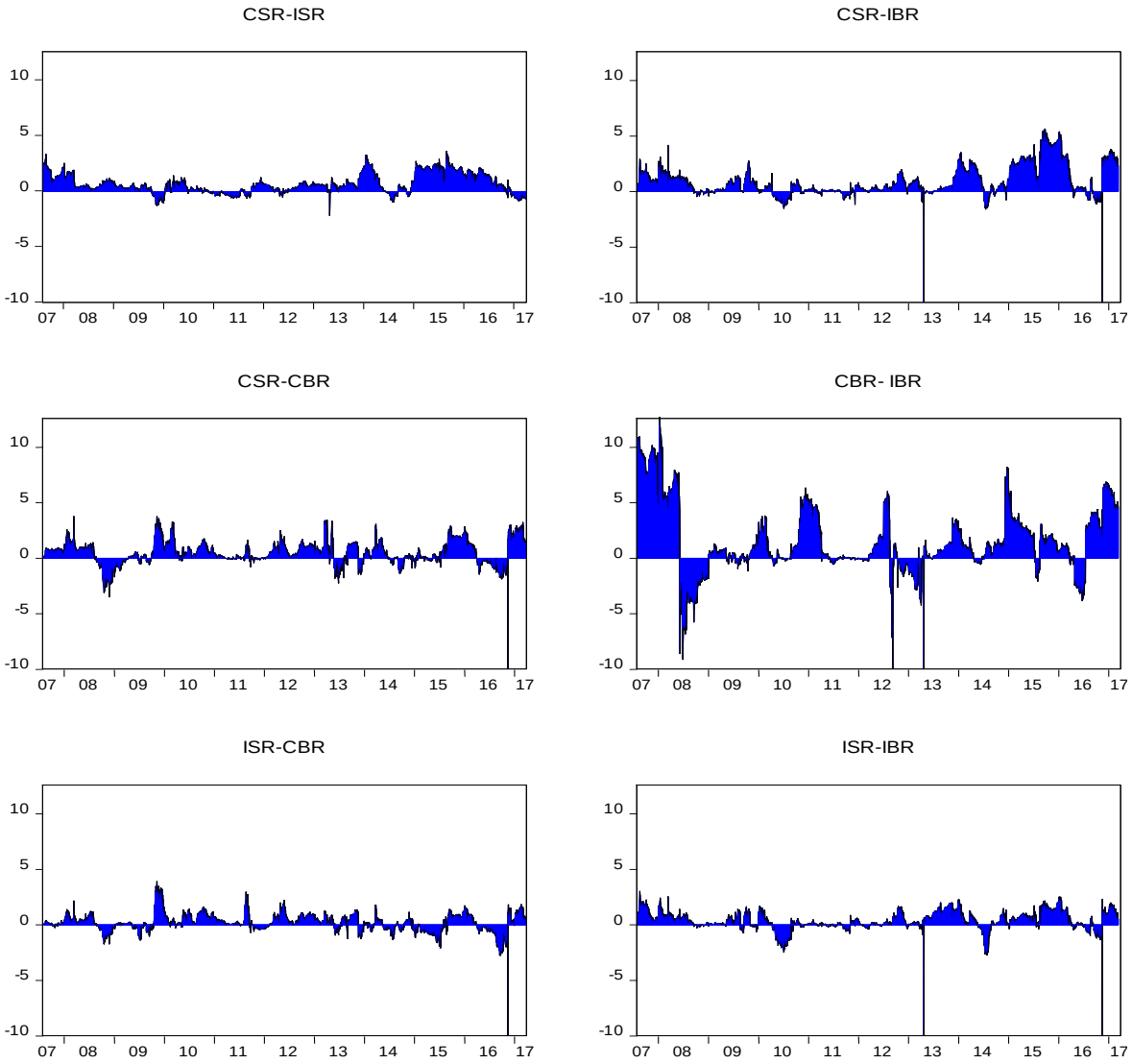
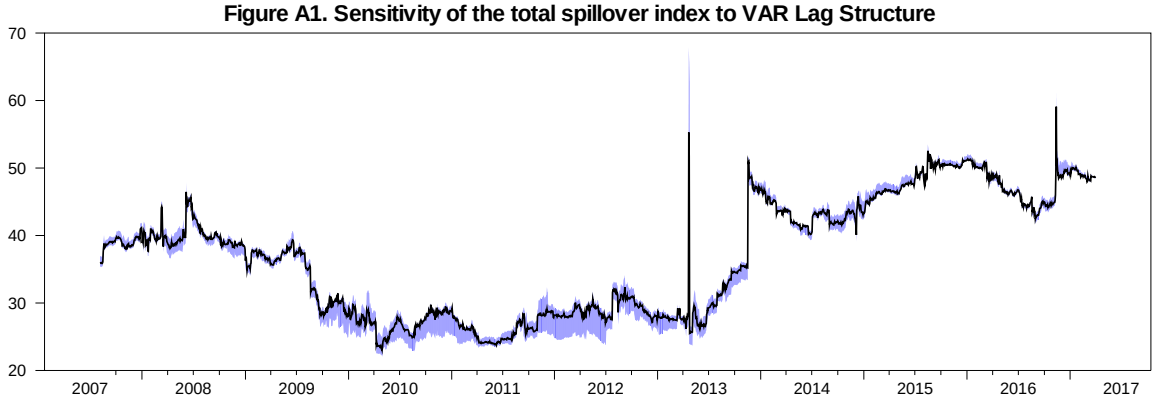


Fig. 6 Net pairwise return spillovers of the Conventional stock market (CSR), Islamic stock market (ISR), Conventional bond market (CBR) and Islamic Sukuk market (IBR) over the sample period 2/8/2007-31/3/2017. Note: these time-varying directional spillover indices have been estimated using a daily VAR model of order 1 with 10-step ahead forecasts and 150-day rolling windows.

5.5. Robustness analysis

We explore the stability and robustness of our empirical results using several robustness checks. To this end, time-varying total spillover indices are estimated using a different lag length for the VAR model (VAR model with lags from 1 to 3) and alternative H-step-ahead forecast error variance decompositions (between 5- to 15-days forecast horizons). Figure 7 presents the minimum, maximum and range of the dynamic total spillover indices associated with the above-mentioned models. Our results remain robust against the choice of alternative lag lengths and forecast horizons in the VAR system. The detailed results are not reported but are available upon request from the authors.



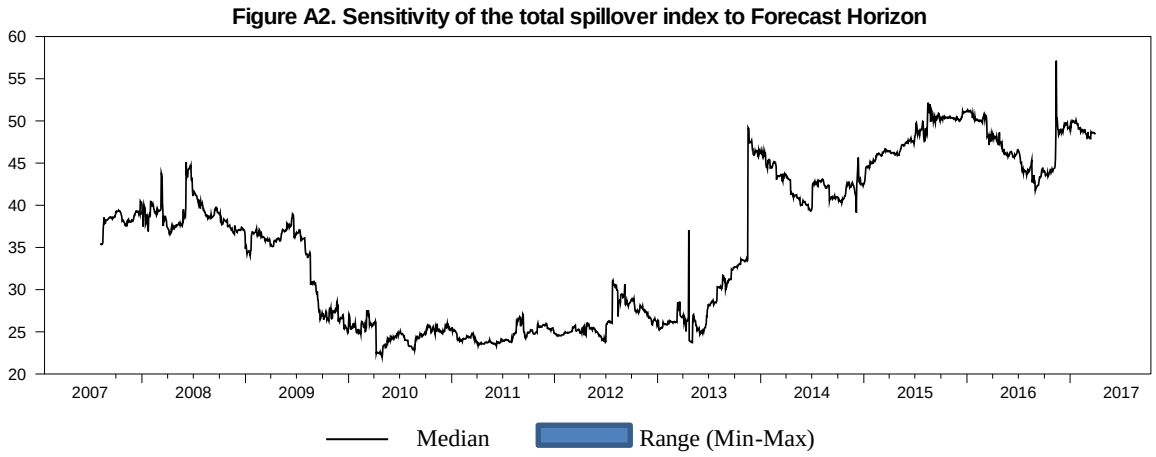


Fig. 7. Robustness tests. Notes: Figure A1 presents the sensitivity analysis of the total spillover index to the VAR lag structure (max, min and median values of the spillover index for VAR orders of 1 to 3). Figure A2 illustrates a sensitivity analysis of the total spillover index to the H-step forecast error variance horizon (min, max and median values over 5- to 15-day forecast horizons).

6. Conclusions

The paper attempts to evaluate the decoupling hypothesis by examining the interlinkages and spillover effects between the Islamic and conventional stocks and bonds/sukuk markets in Malaysia over the period January 3, 2007 to March 31, 2017. Empirical findings show that, on average, one third of the total forecast error variance attributed to spillovers has effects across four markets. This indicates that conventional and Islamic markets are highly interconnected and are linked to each other. Furthermore, the dynamic analysis of the total spillover index using a 150-day rolling window shows that the total spillover index is very responsive and sensitive to external shocks as well as economic and political turbulences. During the tranquil period (end of 2009- May 2012), the total spillovers are very low. However, it generally peaks during economic and political turbulences and reaches up to

57%. Gross directional return spillovers over the sample indicate that both conventional bond and sukuk markets are not fully integrated within the Malaysian financial system. Furthermore, both conventional stock and Islamic stock are highly interlinked and connected with each other whereas conventional bond and Sukuk are more related and attached to each other.

In addition, the examination of dynamic directional spillover indices enables us to estimate the net transmitters and receivers of spillovers across four financial markets and determine which market is the leading contributor to total spillovers. According to the net directional spillovers, the conventional stock and bond markets are considered to be key net transmitters of return spillovers while Sukuk is the most important receiver of spillovers.

The results indicate that while the decoupling hypothesis does not hold for Islamic and conventional stock markets that show high levels of spillovers of returns, the results for conventional bonds and sukuk are more complex showing variations in the spillovers over different time periods. This result is consistent with Maghyereh and Awartani (2016) and Aloui et al. (2015a,b) who documented higher spillovers and increased linkages among Islamic and conventional markets during stress periods. While one way to explain the differences in the spillovers between the conventional bond and sukuk indices is to attribute these to external factors such as financial crises, changes in the legal regime and political uncertainties, another explanation may lie in the differences in the contractual structures of these instruments. As indicated, Islamic stocks are structurally similar and are a subset of conventional stocks, and sukuk can have different contractual formats. Thus, the relationship between sukuk and bonds depends on the type of the former and, as such, may be more complex and hard to understand.

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